Description

Power breaker

The invention relates to a power breaker having a withdrawable-part rack, which can be arranged in a switchgear assembly by means of the withdrawable-part rack.

Power breakers of the generic type are known. By arranging them in their withdrawable-part rack, they can be inserted or withdrawn in or from a switchgear assembly in a simple manner. In this case, significant importance is given to locking the power breaker in its withdrawable-part rack. In particular in the case of power breakers having a high short-circuit disconnection capacity, a force occurs, owing to the loop effect of the current path of the power breaker or of the switchgear assembly, which acts on the power breaker. This force is directed such that the power breaker is forced out of its withdrawable-part rack. In particular in the case of high flowing currents (short-circuit currents), considerable forces acting on the power breaker occur since the force acting rises with the square of the current. If in this case the power breaker is not fixed in its withdrawable-part rack precisely in the line of action of this force, the power breaker may be subjected to a torque owing to leverage, with the result that said power breaker experiences a tipping movement which leads to a relative movement between the connection pieces of the switching contacts of the power breaker and the contact laminations of the withdrawable-part rack. This relative movement may lead to a separation of the switching contacts from the contact laminations, with the result that arc formation cannot be ruled out. As a

result of the high flowing currents, destruction of the power breaker would be associated with this.

It is known to latch the power breaker with its withdrawable-part rack by means of a latching device. In this case, retaining systems are known which are actuated by an insertion shaft or an insertion drive for the purpose of inserting the power breaker in the withdrawable-part rack. Such retaining systems, however, are characterized by a complex design. Furthermore, a minimum amount of play is provided between the restraining elements of the retaining system and the withdrawable-part rack, since only a simultaneous movement between the power breaker and the withdrawable-part rack and lifting-out of the restraining systems is possible.

In addition, rigid systems are known by means of which the insertion direction or the withdrawal direction of the power breaker in or out of the withdrawable-part rack can be blocked. These systems have a relatively small, effective lever arm, such that the high forces which occur in particular in the case of a short-circuit cannot reliably be absorbed.

DE 196 47 747 C1 discloses an insertable device carrier having a latching device, in the case of which a latching rod is displaced at the same time owing to a rotation of an actuating shaft of a main breaker, said latching rod in turn displacing a blocking slide, with the result that latching of the device carrier takes place. As a result, single-point latching of the device carrier is achieved such that it is positioned. However, if high forces are acting owing to high currents flowing (short-circuit currents), the latching rod known from DE 196 47 747 C1 forms a lever arm such that a displacement of the device carrier and thus of a

power breaker from the desired latched position cannot be ruled out. The point of engagement of the latching rod in a latching opening

in a device floor in this case acts as a pivot in order that a deflection of the latching rod can take place.

The invention is therefore based on the object of creating a power breaker of the generic type which can be latched safely in its withdrawable-part rack by means of a simple arrangement.

According to the invention, this object is achieved by a power breaker having the features mentioned in claim 1. As a result of the fact that the latching device of the power breaker can be operated by a switching drive, in particular by a switching shaft of the power breaker, it is advantageously possible to link the closure of the switching contacts of the power breaker with the latching of the power breaker in the withdrawable-part rack. This operative connection, which is thus almost provided, between the closed switching contacts of the power breaker and the latching of the power breaker in the withdrawable-part rack makes it possible to apply a restraining force on the power breaker which is matched to the switching position of the power breaker, and which holds the power breaker securely in the desired position, even in the event of high currents flowing. In particular, a situation is prevented in which the forces injected by the high currents force the connection pieces of the switching contacts and the contact laminations of the withdrawable-part rack apart from one another, with the result that the arc formation mentioned initially can be suppressed.

In one preferred refinement of the invention, provision is made for the switching shaft to comprise at least one actuating element, which is connected to the

switching shaft such that it is fixed against rotation and by means of which the latching device can be brought into the latched position or the unlatched position. As a result,

the actuation of the latching device is possible in a particularly simple manner. The switching shaft of the power breaker in this case bears a gear or gear segment, which is arranged such that it is fixed against rotation, preferably outside of an exterior limiting structure. As a result, it is possible in a particularly simple manner to couple the switching movement of the contact arrangement to the actuation of the latching device. The switching shaft undergoes a rotary movement, which is at the same time used to actuate the latching device, for connection, i.e. for the purpose of closing the switching contacts, or for disconnection, i.e. for the purpose of opening the switching contacts, of the power breaker.

In particular if, in one further preferred refinement of the invention, the axially displaceable latching bolts have a toothed rod section which meshes with the actuating element, the rotary movement of the switching shaft can easily be converted into a lifting movement of the latching bolts. It is thus possible to lock the power breaker in a reliable manner.

In accordance with further preferred refinements of the invention, the actuating element can be operatively connected to the latching bolt via a crank arrangement, open or closed cam disks, cable pulls, Bowden cables or the like. Irrespective of the specific design of this operative connection, the rotary movement of the switching shaft can be transferred in a simple manner to the latching movement or unlatching movement of the latching device.

All of the embodiments are characterized by a robust

design requiring little or no maintenance, with the result that they are particularly suitable for being used in

power breakers which are subjected to relatively robust operating conditions.

Further preferred refinements of the invention are given by the remaining features mentioned in the subclaims.

The invention will be explained in more detail below in exemplary embodiments with reference to the associated drawings, in which:

figure 1 shows a schematic view of a power breaker;

figure 2 shows a schematic plan view of a first embodiment of a latching device of the power breaker; and

figure 3 shows a second embodiment of a latching device.

Figure 1 shows a schematic illustration of a power breaker 10, for reasons of clarity details being omitted from the illustration. In accordance with the illustration, the power breaker is, for example, a three-pole power breaker.

The power breaker 10 comprises a switching shaft 12, by means of which movable switching contacts of the power breaker 10 can be guided towards fixed switching contacts (closed position) or away from said switching contacts (open position). For this purpose, the switching shaft 12 can be rotated about its longitudinal axis in a corresponding angular range by a drive arrangement (not shown).

The power breaker 10 can be arranged in a switchgear assembly (not shown) by means of a withdrawable-part rack 14 which is merely indicated.

The switching shaft 12 is extended beyond lateral structural elements 16, for example retaining and accommodating frames, and bears there, on both sides, a latching device which is given the overall designation 18.

The design and operation of the latching device 18 will be explained in more detail with reference to figure 2.

The latching device 18 comprises an actuating element 20, which is arranged such that it is fixed against rotation on the switching shaft 12 and which interacts with a latching bolt 22. The latching bolt 22 is arranged such that it can be displaced axially and is guided, for example by means of guide rollers 24.

The actuating element 20 is formed by a gear segment 26, which has an associated toothed rod section 28 of the latching bolt 22. The gear segment 26 and toothed rod section 28 are in meshing engagement with each other.

The latching device 18 illustrated in figures 1 and 2 has the following operation:

When the switching shaft 12 is actuated for the purpose of closing the switching contacts of the power breaker 10, said switching shaft is rotated about its axis of rotation 30, as shown in the illustration in figure 2 in the counterclockwise direction. As a result, the actuating element 20, which is connected to the

switching shaft 12 such that it is fixed against rotation, experiences an identical rotary movement. As a result of the fact that the actuating element 20 meshes with the latching bolt 22, the latching bolt 22

experiences a lifting movement which is directed in the direction of the arrow 32. As a result, the latching bolt 22 engages in a corresponding opening 34 in the withdrawable-part rack 14. For the purpose of inserting the latching bolt 22 precisely in the opening 34, said latching bolt 22 may have a conical tip 35.

It becomes apparent that the switching movement of the power breaker 10 is transferred in a simple manner to the actuation of the latching device 18 via the switching shaft 12. This means that, when the power breaker 10 is connected, the latching device 18 is automatically moved over into the latched position. The power breaker 10 is thus in any case secure during its connected state. In this case, a controlled movement of the latching device 18 takes place such that it is already latched before primary arcing contact of the power breaker 10 is effective. This ensures that the locking has already reliably taken place even in this connected state of the power breaker 10.

Unlatching of the latching device 18 takes place in analogous fashion by opening the power breaker 10. In this case, in turn the switching shaft 12 experiences an opposite rotary movement about the axis of rotation 30, in accordance with the illustration in figure 2), in the clockwise direction. The correspondingly resulting rotary movement of the actuating element 20 is transferred to the latching bolt 22, with the result that said latching bolt 22 is lowered in opposition to the lifting movement 32, with the result that the latching bolt 22 is moved out of engagement with the opening 34.

As indicated in figure 2, the actuating element 20 has

associated with it a further latching bolt 22' which is arranged

diametrically opposite the latching bolt 22. The design and operation of the latching bolt 22' corresponds to those of the latching bolt 22. Owing to the diametrically opposite arrangement, in the case of a lifting movement 32 of the latching bolt 22, the latching bolt 22' experiences a lifting movement 32' in the opposite direction. This makes it possible at the same time to latch the power breaker 10 both in an upper section and in a lower section of the withdrawable-part rack 14.

In the case of two latching devices 18 being provided, there is thus a total of four latching points. These latching points ensure secure positioning of the power breaker 10 in its withdrawable-part rack which takes place even in the event of high currents and which is resistant to the action of high forces. Relative movements of connection pieces (not illustrated in any more detail) of the switching contacts and contact laminations of the withdrawable-part rack in relation to one another can thus be prevented.

Figure 3 shows a modified embodiment of the latching device 18. In this case, figure 3a shows the unlatched position, and figure 3b shows the latched position. Identical parts to those in the preceding figures are provided with identical reference numerals and will not be explained again.

In contrast to the exemplary embodiment shown in figures 1 and 2, the actuating element 20 is in this case in the form of a crank arrangement 36, which interacts with a corresponding link guide 38 of the latching bolts 22 and 22', respectively. This also makes it possible, in a simple manner, for

the rotary movement of the switching shaft 12 to be converted into the lifting movement 32 of the latching bolts 22 and 22'.

The actuating element 20 has associated with it two diametrically opposite latching bolts 22 and 22', respectively. Here too, an actuating element 20, in the form of a twin-crank arrangement, interacts with link guides 38 of the in this case two latching bolts 22 and 22'.